SYNTHESIZED STEREO TUNER

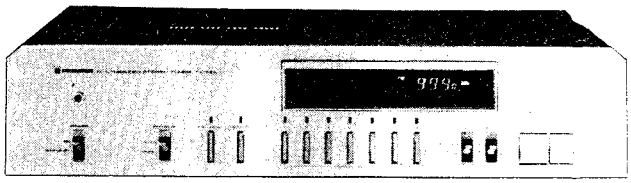
TX-710L /HE, HB

SERVICE MANUAL

MODEL TX-710L COMES IN TWO VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
HE	AC 220V and 240V (Switchable)	Europe model
HB	AC 220V and 240V (Switchable)	United Kingdom model

CONTENTS

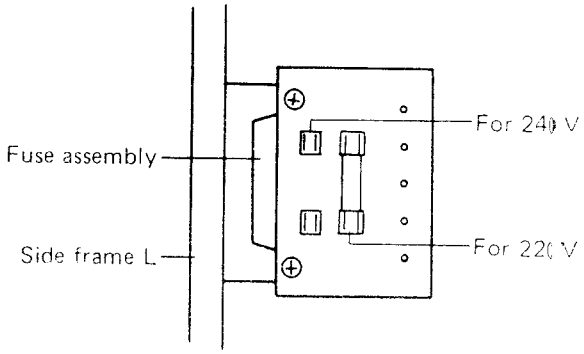


LINE VOLTAGE SELECTION

Line voltage can be changed as follows:

1. Disconnect the AC power cord.
2. Remove the bonnet case.
3. Take out the fuse from the P.C. board.
4. Re-install the fuse in the correct voltage indication.
5. Stick the line voltage label on the rear panel.

Description	Part No.
220V label	AAX-193
240V label	AAX-192



1. SPECIFICATIONS

FM Tuner Section

Usable Sensitivity 10.8dBf (1.9μV)
Sensitivity (DIN)
MONO 1.5μV
STEREO 50μV
50dB Quieting Sensitivity
MONO 16dBf (3.5μV)
STEREO 38dBf (44μV)
Signal-to-Noise Ratio (at 85dBf)
MONO 78dB
STEREO 75dB
Signal-to-Noise Ratio (DIN)
MONO 71dB
STEREO 62dB
Distortion (at 65dBf)
MONO 1kHz; 0.08%
STEREO 1kHz; 0.15%
Distortion (DIN)
MONO 1kHz; 0.08%
STEREO 1kHz; 0.15%
Capture Ratio 1dB
Alternate Channel Selectivity (400kHz) 60dB
Stereo Separation 1kHz; 40dB
Frequency Response . . . . . 20Hz to 15kHz $^{+0.2}_{-1}$dB
Spurious Response Ratio 65dB
Image Response Ratio 45dB
IF Response Ratio 80dB
AM Suppression Ratio 55dB
Antenna Input . . . . . 300 ohms balanced, 75 ohms unbalanced

LW Tuner Section

Sensitivity
IHF, ferrite antenna 450μV/m
IHF, external antenna 45μV/m
Selectivity 25dB
Signal-to-Noise Ratio 50dB
Image Response Ratio 40dB
IF Response Ratio 70dB
Antenna . . . . . Ferrite loopstick antenna

MW Tuner Section

Sensitivity
IHF ferrite antenna 300μV/m
IHF external antenna 30μV
Selectivity 25dB
Signal to Noise Ratio 50dB
Image Response Ratio 40dB
IF Response Ratio 70dB
Antenna . . . . . Ferrite loopstick antenna

Audio Section

Output (Level)
FM (100% MOD) 650mV
AM (30% MOD) 150mV

Miscellaneous

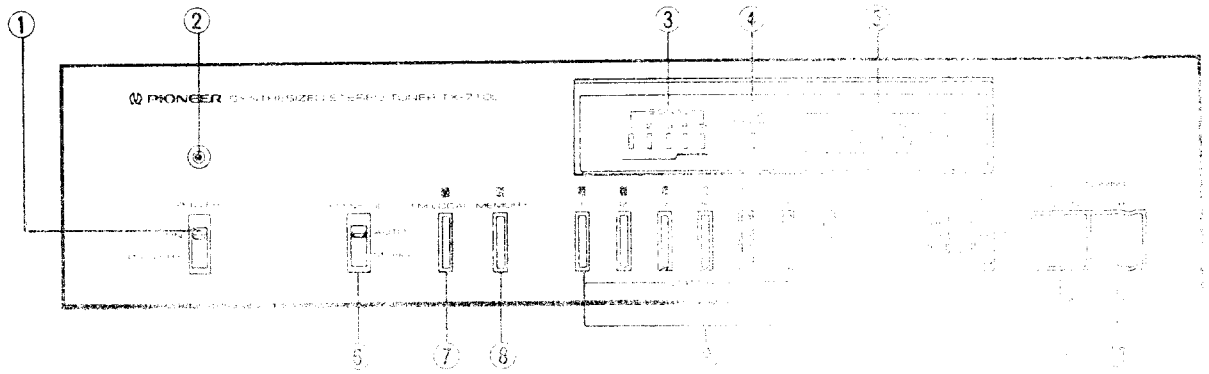
Power Requirements
HE model . . . . . a.c. 220V, 50/60Hz
HB model . . . . . a.c. 240V, 50/60Hz
Power Consumption 16W
Dimensions . . . . . 420(W) x 94(H) x 270(D)mm
16-9/16(W) x 3-11/16(H) x 10-5/8(D) in
Weight (Without Package) 3.3kg (7lb 4oz)

Furnished Parts

FM T-type antenna 1
Operating Instructions 1

NOTE:
Specifications and the design subject to possible modification without notice due to improvements.

2. FRONT PANEL FACILITIES



① POWER SWITCH

When this switch is set to the ON position, power is supplied to the tuner's main circuits. The unit's power switch is geared to selecting the transformer's secondary and so even at the STAND-BY position, the unit's circuitry will work as long as the power cord is connected to the power outlet. For this reason, the programmed broadcasting stations will not be erased.

Disconnect the power cord from the power outlet when you do not plan to use the unit for a long period of time. When it has been disconnected, the broadcasting stations remain programmed for about 3 days.

② POWER INDICATOR

This comes on as soon as the tuner's power switch is set to ON.

③ SIGNAL INDICATORS

These indicators "1" through "5" light up in accordance with the strength of the signal.

④ FM STEREO INDICATOR

This indicator lights up when the tuner is receiving a stereo program.

⑤ FREQUENCY DISPLAY

This indicates the tuned frequency.

⑥ FM MODE SWITCH

This is used to select the FM reception mode.

AUTO . . When an FM broadcast is being received in stereo, the unit will automatically set reception to mono in the event of an FM mono broadcast.

MONO . . If there is a great deal of noise or if the broadcasting station signals are weak during reception at the AUTO position, set the switch to this position.

⑦ FM LOCAL SWITCH

This selects the stop level with auto tuning.

When this switch is depressed to the LOCAL position, a broadcasting station with a relatively strong input level is chosen when the tuning switch is depressed and the frequency band is scanned, and the scanning operation stops.

When the switch is set to the OFF position (the indicator goes off), frequency scanning stops even with broadcasting stations with a weak input level, and the station's program can be received.

When the power switch is at the ON position, the FM LOCAL switch will always return to the OFF position.

⑧ MEMORY SWITCH

This is depressed when presetting a broadcasting station into one of the station call switches. For presetting, depress the memory switch and then depress the station call switch which will be used for presetting the station while the indicator above the memory switch remains lighted (about 5 seconds).

⑨ STATION CALL SWITCHES

These are depressed to call out preset broadcasting stations and to preset the stations.

To call out a station, first set the desired frequency band using the function switch and then depress the desired switch.

NOTE:
If the AM selector switch is set to a position which does not correspond to the broadcasting wave band with the preset station with AM station recall, the numbers on the frequency display will change but only interstation noise will be heard.

⑩ FUNCTION SWITCH

This switch is used to select the type of broadcasting waves.

FM . . . . For reception of FM broadcasting.

AM . . . . For reception of AM broadcasting.

⑪ AM SELECTOR SWITCH

This switch is used to select the type of AM broadcasting waves.

MW . . . . For reception of MW broadcasting.

LW . . . . For reception of LW broadcasting.

NOTE:
This switch can be operated only when the function switch is at AM position.

⑫ AUTO TUNING DOWN SWITCH

When this switch is depressed lightly, the reception frequency automatically scans the frequencies below that on the frequency display. As soon as a station is received, the frequency display stops and the optimum tuned state is held by the AFC circuit.

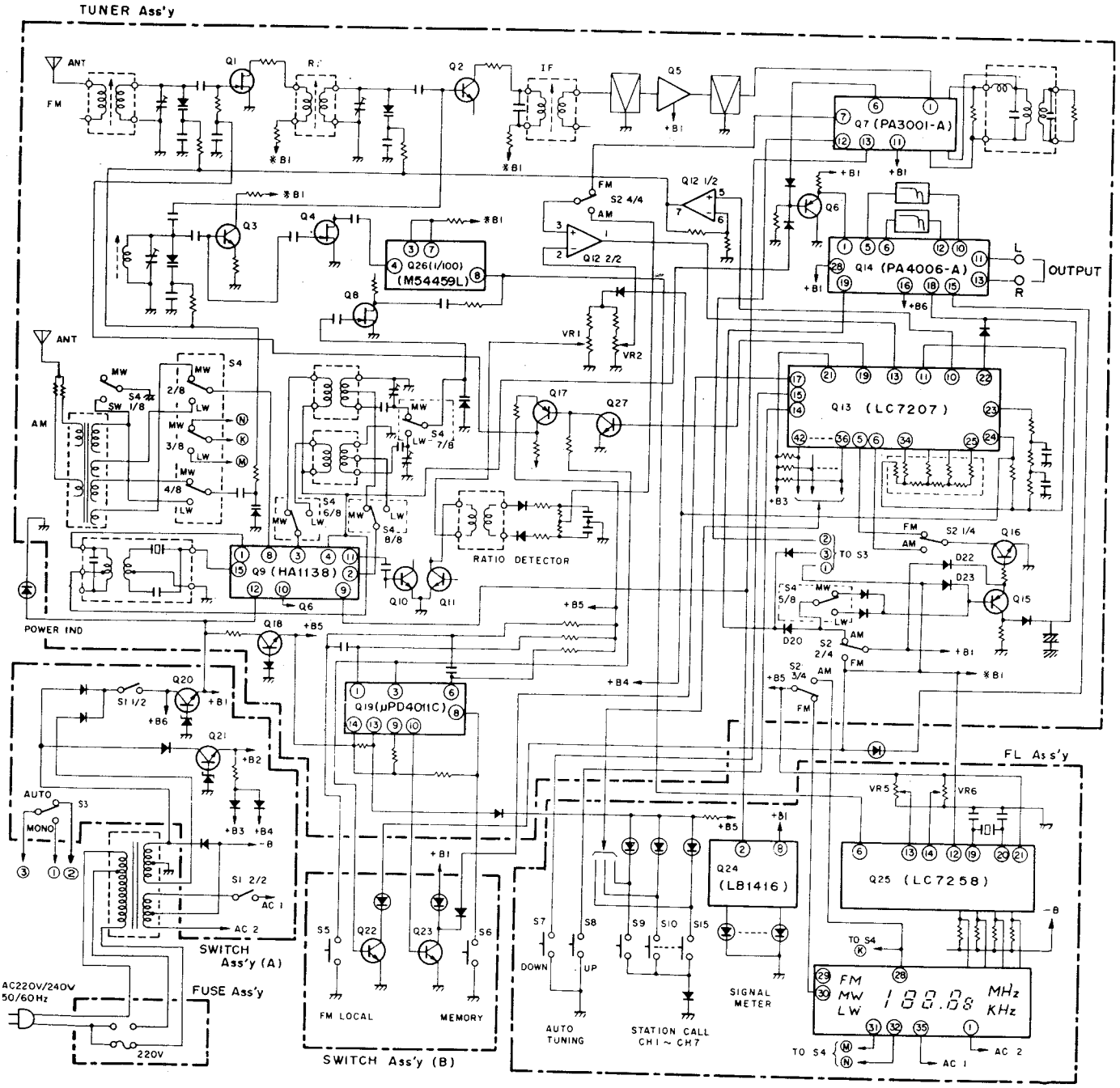
NOTE:
If the switch is kept in the depressed position, scanning continues without automatically stopping even when there are broadcasting stations. When the lower limit of the frequency band is reached, scanning jumps to the highest frequency and then proceeds again down the band.

⑬ AUTO TUNING UP SWITCH

When this switch is depressed lightly, the reception frequency automatically scans the frequencies above that on the frequency display. As soon as a station is received, the frequency displays stops and the optimum tuned state is held by the AFC circuit.

NOTE:
If the switch is kept in the depressed position, scanning continues without automatically stopping even when there are broadcasting stations. When the upper limit of the frequency band is reached, scanning jumps to the lowest frequency and then proceeds again up the band.

3. BLOCK DIAGRAM



4. CIRCUIT DESCRIPTIONS

The TX-710L tuner stage features an auto-tuning mechanism incorporating variable capacitor diodes (vari-caps) and voltage synthesizer IC circuitry. In addition, it is also possible to preset up to 7 different broadcasting stations in both the AM (MW & LW) and FM bands.

FM TUNER

Front-end

The FM front-end in the TX-710L consists of a J-FET equipped single-stage RF amplifier and a variable capacitor diode type tuning capacitor (equivalent to a normal 3-ganged tuning capacitor). The basic operation involves the conversion of digital codes to analog voltages by a D-A converter made of ladder resistor and an LSI-incorporated 10-bit up/down counter, and applying this voltage to the variable capacitor.

IF Amplifier and Detector

The FM IF amplifier includes 2 ceramic filters, a differential amplifier equipped IC (HA1201), and an FM IF system IC (PA3001-A). In addition to filter loss compensation, HA1201 also serves as a limiter. PA300-1 contains the IF amplifier, limiter, and detector (quadrature detector) stages.

FM Stereo Decoder

The FM stereo decoder is incorporated in the PLL MPX IC (PA4006-A) which has been designed to include the functions formerly handled by PA1001-A (FM stereo decoder IC) and PA1002-A (AF muting IC). This FM decoder features the "direct through & chopper system" for improved S/N ratio and reduced distortion.

AM TUNER

The AM tuner stage features an IC (HA1138) incorporating the RF amplifier, mixer, local OSC, IF amplifier and detector, AGC circuits. The tuning circuit consists of variable capacitor diodes equivalent to a conventional 2-ganged tuning capacitor. As in the FM tuner, a voltage obtained by D-A conversion (ladder resistor and LC7207 LSI) is applied to this variable capacitor diodes. In addition, the S-curve involved in fine tuning by the auto tuning system is detected by a special ratio detector circuit.

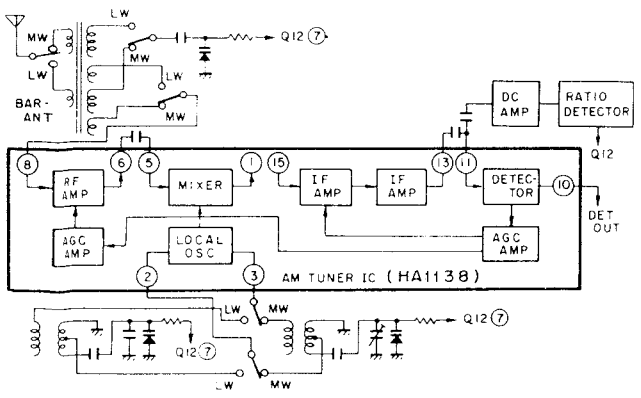


Fig. 4-1 AM tuner block diagram

VOLTAGE SYNTHESIZER

The "heart" of the auto-tuning mechanism is served by the LC7207 LSI which contains the AFC circuit (where the S-curve characteristics are employed for fine tuning purposes) in addition to the preset, auto-search tuning, auto-stop, and last-memory functions for up to 7 separate broadcasting stations in each of the FM and AM bands.

COUNTER

During FM mode output signals from the local oscillator are passed via an FET buffer amplifier, divided by a 1/100 prescalar (M54459L), and applied to the counter IC (LC7258).

During AM mode local oscillator output signals are passed via another FET buffer amplifier, but are then applied directly to the counter IC.

The input signal is compared with a reference signal (4MHz) generated by an external oscillator (i.e. not incorporated in the LC7258 LSI), resulting in the tuned frequency being displayed in 50kHz steps during FM mode, and 1kHz steps during AM mode.

FLUORESCENT TUBE INDICATOR

The fluorescent tube indicator employed here is of the static drive type. In addition to tuned frequency, this display also includes "MHz" during FM mode, and "kHz" during MW and LW reception.

FM AUTO-STOP LEVEL CONTROL STAGE (FM LOCAL SWITCH)

During FM auto-search tuning mode, weak distant broadcasting stations are ignored. Only stations with an antenna input level above a certain fixed value will be tuned. However, if the FM LOCAL switch is pressed (ON position) and the corresponding indicator LED turned on, the front-end gain is reduced by the LC7207 LSI. Then following auto-stop, the front-end gain is increased again back to the former level to ensure high sensitivity reception of the tuned broadcasting station. This function is turned on and off alternately by a flip-flop circuit in conjunction with the μPD4011C IC every time the FM LOCAL

switch is pressed. Note, however, that it is always switched to the OFF position when the power supply is turned on.

POWER SUPPLY BACK-UP CIRCUIT

With the power switch in the TX-710L connected to the secondary coil of the power transformer, all frequencies stored in the STATION CALL channels, and also the frequency of the last-used channel, will be stored in the LC7207 LSI when the power switch is left in the STAND-BY position. And even if the power cord is unplugged from the AC mains socket (thereby cutting the power to the primary coil) the LSI memory will be retained for at least 3 days by charge stored in a capacitor in the LSI power supply circuit.

LSI (LC7207) Terminals and Functions

The functions of the various terminals of the voltage synthesizer (LC7207) are described in brief below.

- Pin 1 (CR1)
  An oscillator circuit is formed by connecting this terminal to an external RC time constant circuit. The signals generated serve as the basic clock signals for the LSI.
- Pin 2 (CR2)
  A timer circuit is formed by connecting this terminal to an external RC time constant circuit. This timer is used to determine the pulse width of the MUTE output signals employed during band switching.
- Pin 3 (BUC)
  When a low level signal is applied to this terminal (LSI internal memory back-up control), all functions apart from "memory protect" are cancelled.
- Pin 5 (FM)
  The TX-710L is switched to FM mode when a low level input signal is applied to this terminal, this status being maintained even if the terminal is subsequently switched to high level (low level holding time: 5ms min).
- Pin 6 (MW)
  Likewise, the TX-710L is switched to AM mode when a low level input signal is applied to this terminal, this status being maintained even if it is switched to high level soon afterwards (low level holding time: 5ms min).
- Pin 10 (CV out)
  This is the analog switch output terminal where the output voltage applied to the variable capacitor appears.
- Pin 11 (CV in)
  This is the analog switch input terminal to which the R-2R ladder output voltage is applied.
- Pin 13 (S-curve)
  FM and AM S-curve voltages (representing the degree of change in detector DC level when tuning to and away from a station) are applied to this AFC (Automatic Frequency Control) control signal input terminal.
- Pin 14 (UP)
  When a low level signal is applied to this auto-search tuning input terminal, UP search tuning is commenced. This tuning mode is stopped again following AFC operation when the S-curve voltage is applied to pin 13 (UP search low level holding time: 5ms min). If the low level signal is applied continually during the UP search tuning mode, the tuning operation will continue even if the S-curve voltage is applied to pin 13.

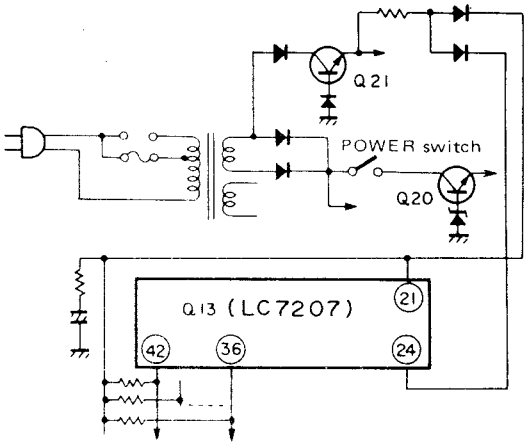


Fig. 4-2 Power supply back-up circuit

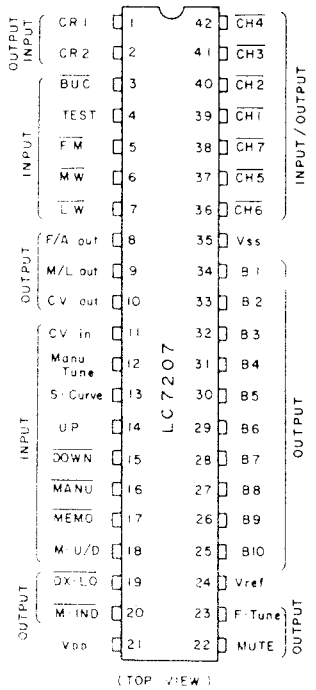


Fig. 4-3 LC7207 Top view

- Pin 15 (DOWN)
  Likewise, the application of a low level signal to this auto-search tuning input terminal results in the start of DOWN search tuning. The DOWN tuning mode is also stopped after AFC operation following the application of the S-curve voltage to pin 13 (DOWN search low level holding time: 5ms min). In this case, too, the search tuning mode is maintained if the low level signal is applied continually, even if the S-curve voltage is applied to pin 13.
- Pin 17 (MEMO)
  The preset memory input terminal. Memory enable status is maintained only while a low level signal is applied to this terminal.
- Pin 19 (DX-LO)
  This output terminal is used in the control of the reception sensitivity during auto-search mode. It is switched to low level only during search mode, and reverted to high level at all other times.
- Pin 21 (V_{DD})
  The LSI power supply terminal.
- Pin 22 (MUTE)
  During auto-search tuning and preset tuning modes, and when switching from one band to another, the high level output signal appearing at this terminal is used as the muting control signal.
- Pin 23 (F-Tune)
  The 8-step PWM (pulse width modulation) output signal appearing at this terminal is used in fine tuning operations. (At all other times, a 50% duty signal, T = 1.5ms, is generated). The output signal is passed via an externally connected low-pass filter to form the compensatory voltage for fine tuning purposes.
- Pin 24 (V_{ref})
  Reference voltage (for D-A converter, wind comparator and reference comparator).
- Pin 25 — Pin 34 (B10 — B1)
  Outputs for the 10-bit up/down counter. With the R-2R ladder resistor connection, output signals are D-A (digital analog) converted.
- Pin 35 (V_{SS})
  The LSI ground terminal.
- Pin 36 — Pin 42 (CH1 — CH7)
  The frequencies of broadcasting stations stored in the memory are tuned by the corresponding terminal being switched to low level. And when the MEMO terminal is switched to low level, the frequency of the station tuned at that time will be stored in the memory. (Low level holding time for tuning and memory: 20ms min).
- Pins 12 and 16
  FM and AM tracking purposes.

NOTE:
All other pins not included in the above list are not employed in the TX-710L.

VOLTAGE SYNTHESIZER SYSTEM (LSI LC7207)

- **Auto-Tuning** (Fig 4-4)

When either switch S8 (UP) or switch S7 (DOWN) is pressed, the corresponding LSI (LC7207) terminal pin 15 or pin 14 is connected

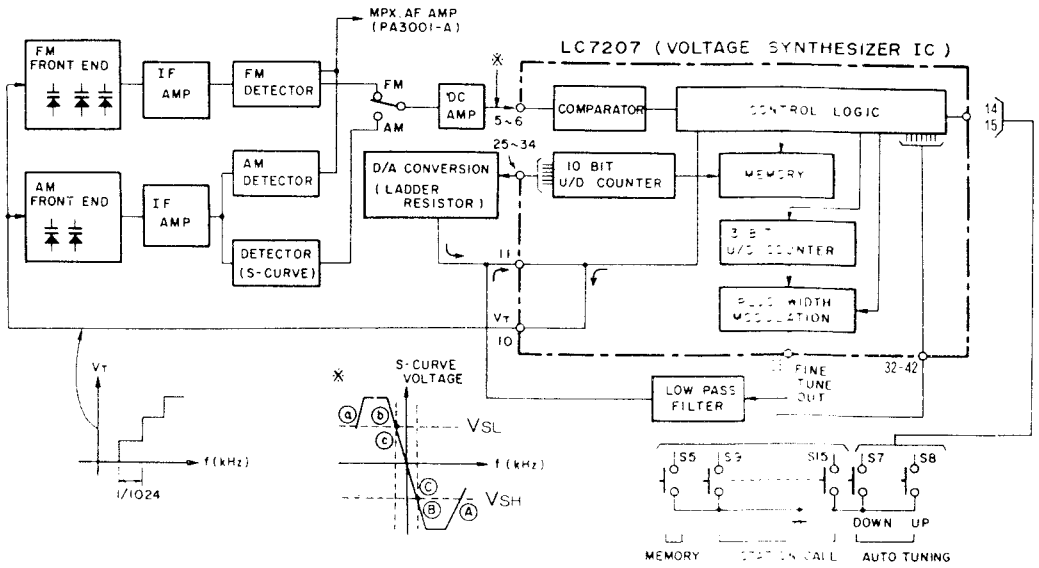


Fig. 4-4 Auto-tuning

to ground, resulting in the terminal being switched to low level. The control logic circuitry incorporated in the LSI is thereby activated, resulting in the start of either UP or DOWN search tuning operations. The subsequent sequence of events following the pressing of the UP switch (S8) is described below.

The 10-bit UP/DOWN counter (rough tuning) is activated by an instruction from the control logic circuit, resulting in the digital code outputs stored in the memory circuit being applied to pins 25 to 34. This 10-bit code is D-A converted (digital to analog conversion) by the R-2R ladder resistor, and then passed one step (1/1024) at a time as tuning voltage (V_T).

This V_T is progressively increased one step at a time, resulting in the tuning frequency also being increased stepwise. And when the frequency of a broadcasting station is approached, the S-curve voltage passes the V_{SL} a point as shown in Fig. 4-4. With further increases in the V_T voltage, the S-curve voltage starts to decline again, passing through point V_{SL} ⓑ. Then with continued decrease, a counter voltage at V_{SH} Ⓒ is encountered. After completing these 3 steps from ⓐ to ⓒ, the auto-search mode is halted (rough tuning).

A 3-bit U/D counter employed for fine tuning purposes is then activated by an instruction from the control logic incorporated in the LC7207 LSI, resulting in the AFC operation (fine tuning) being started up by the S-curve.

On the other hand, when S7 (DOWN) is pressed, the procedure described above occurs in the reverse order. And when the frequency of a broadcasting station is approached, the S-curve voltage passes via the V_{SH} Ⓐ and Ⓑ S-curve voltage points and encounters V_{SL} at ⓒ. The search is stopped automatically, resulting in the start of the AFC operation.

- **AFC Operation (Fig. 4-5)**

The AFC operation makes use of the S-curve characteristics (voltage) of the detector circuit during both FM and AM reception. In the AM circuit, a ratio detector S-curve generator circuit is used, an output being obtained with a sufficiently high enough gain from the DC amplifier (see Fig. 4-4).

If for some reason, the tuned frequency is displaced to the high side of the broadcasting frequency, the S-curve voltage will generate a minus potential. V_{SL} and V_{SH} represent the upper and lower threshold levels of the LC7207 comparator shown in Fig. 4-5. Once the minus potential drops below the V_{SH} threshold, an instruction from the control logic is passed to the 10-bit U/D counter (for rough tuning) and the 3-bit U/D counter (for fine tuning). This results in control of the variable capacitor, leading to change in the tuning voltage (V_T) in order to recover the precise tuning position. If, on the other hand, the frequency is displaced on the low side, the control logic circuit is again activated (but due to a positive potential exceeding the V_{SL} threshold) resulting in the retention of the precise tuning point.

- **S-Curve Detector Circuit (Fig. 4-6)**

When a broadcasting station is tuned by auto-tuning, the exact tuning position is attained by AFC operation. The S-curve required for this AFC operation is detected in the following way.

The IF output signal is obtained from pin 7 of Q7 (PA3001-A) during FM reception, and from pin 11 of Q9 (HA1138) during AM reception. This IF is amplified by a differential amplifier circuit, and the S-curve subsequently detected by the ratio detector. S-curve displacement (i.e. shift in the center voltage of the S-curve) in both FM and AM mode is compared with a reference voltage

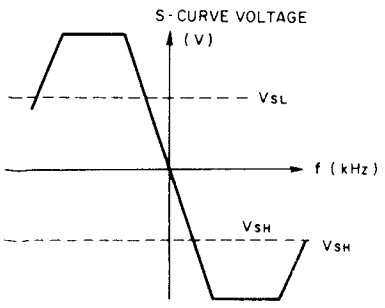


Fig. 4-5 S-Curve characteristics

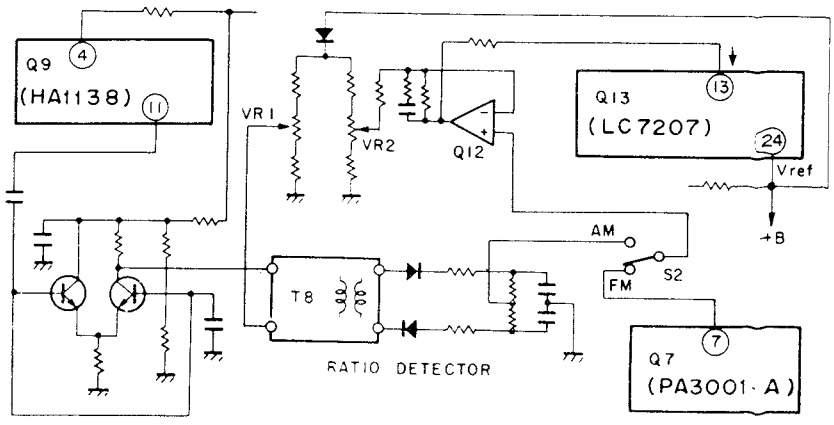


Fig. 4-6 S-Curve detector circuit

(LC7207 V_{ref}) in Q12 (μPC4558C), and the consequent error then applied to pin 13 of Q13 as the AFC operation control signal.

IC · Q19 (μPD4011C) Functions

The NAND gate IC incorporated in Q19 forms a one-shot flip-flop which operates in combination with several other external circuit components for FM LOCAL and MEMORY control purposes.

- **FM Local**

(Note that FM LOCAL and FM MUTING involve the same type of operation).

Pin 3 of Q19 is switched to low level at the same time that the POWER switch is turned on. Q17 is thus turned on and the Q1 gate is dropped to 0V potential (normal bias), thereby resulting in normal front-end operation. In addition, switching pin 3 of Q19 to low level also keeps Q22 and D43 turned off.

If the FM LOCAL switch (S5) is then turned on, pins 6 and 1 of Q19 are also switched to low level, resulting in the pin 3 output being inverted to high level, and Q17 being turned off. The −B line voltage is thus applied to Q1 via R528 and R23 as reverse bias, thereby reducing the Q1 gain, and subsequently the sensitivity of the front-end. Any broadcasting frequencies below a certain fixed level will not, therefore, be received.

Pin 19 of Q13 is normally at high level, being switched to low level only during auto-search tuning mode. Once a broadcasting station is tuned and the auto-search mode is stopped, the pin 19 output is switched back to high level, and Q27 consequently turned on. This results in Q17 being turned on, thereby cancelling the reverse bias applied to Q1. With Q1 operating normally again, the broadcasting frequency will be received at high sensitivity.

- **MEMORY and STATION CALL**

Frequencies of tuned broadcasting stations are stored in the memory by the following procedure.

As can be seen in Fig. 4-7, this circuit is also formed by a flip-flop. When the MEMORY switch S6 is turned on, pin 8 of Q19 is switched to low level, resulting in the output of Q19 pin 10 being switched to high level for a fixed period of time (determined by the C504/R510 time constant — memory enable period: approx. 5 seconds). This results in Q23 being turned on and pin 17 of Q13 being switched to low level, thereby enabling tuned frequencies to be stored in the memory block

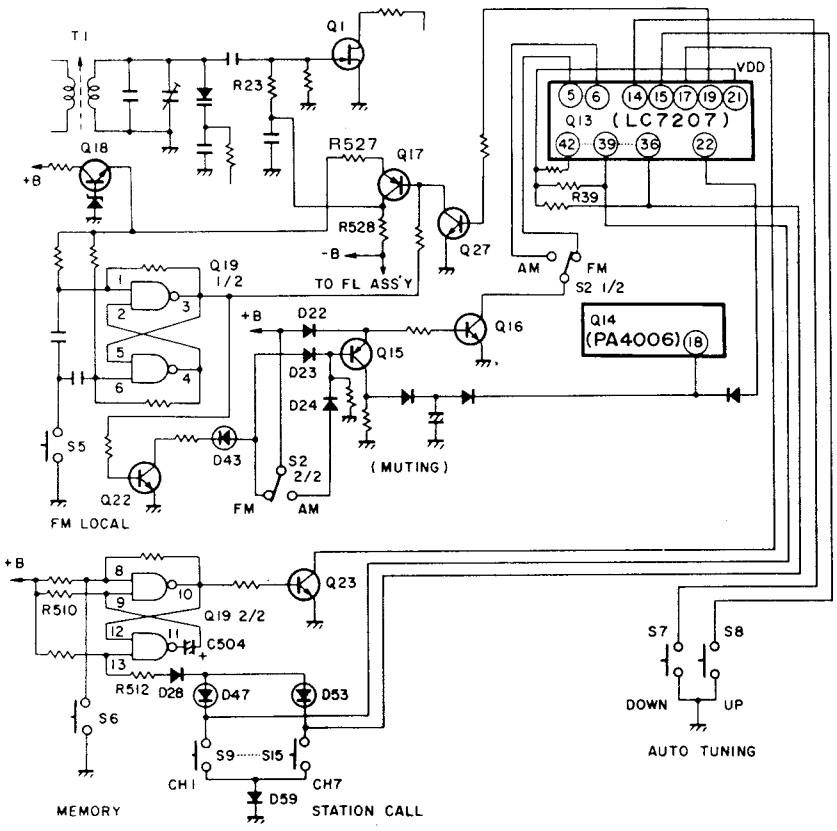


Fig. 4-7 FM local, memory and station call circuit

inside the LSI.

If the STATION CALL switch (preset switch) S9 is then pressed, +B will be connected to ground via R512, D28, D47 and D59, resulting in pin 13 of Q19 being switched to low level, and pin 10 being reset to high level. Q23 will thus be turned on and pin 17 of Q13 switched to low level (and the tuned broadcasting frequency will thus be stored in the memory).

Pins 36 to 42 of Q13 are the preset input terminals. When the S9 switch is pressed, the V_{DD} voltage (IC reference voltage) is passed to ground via R428, S9 and D59, resulting in a drop in the voltage being applied to pin 39 of Q13. Pin 39 is thus switched to low level, and the tuned broadcasting station is thereby stored in CH1.

Station Calling

The frequencies of preset broadcasting stations are retrieved in the following way.

When a STATION CALL switch (S9 — S15) is pressed, pin 17 of Q13 is switched to low level. An instruction is thus issued from the LSI (LC7207) control logic, resulting in the activation of the 10-bit U/D counter in accordance to the frequency data stored in the memory block. Then the memory stored frequency is hunted by ladder resistance, and the U/D counter again activated for AFC operation and fine tuning purposes.

DISPLAY CIRCUIT

This LSI controls the display of tuned FM frequencies (5 digit display to the nearest 50kHz) and tuned AM frequencies (4 digit display to the nearest 1kHz).

During FM reception, the FM LOCAL signal (the actual tuned frequency + IF frequency) divided by 100 in the prescalar IC (M54459L) is applied to pin 6 of Q25 (LS7258). A reference frequency (4MHz) is generated on pins 19 and 20 of Q25 by a crystal oscillator. This reference frequency is then divided by the LSI counter to a frequency which permits direct comparison with the input signal applied to pin 6.

Upon comparison with the pin 6 input signal, the output is passed to the frequency counter. A latch circuit stores each signal temporarily for a brief period while waiting for the previous frequency display to be completed. The signal from the frequency counter is then displayed as the tuned frequency in the fluorescent display tube by command from the segment driver circuit.

Frequency display discrepancies (in 50kHz units in the FM band, and 1kHz units in the AM band) caused by drift in the IF circuit are corrected by the IF frequency fine tuning circuit where frequency shifts are converted to voltage levels in the VR connected to pins 13 and 14. In other words, frequency drift is corrected by voltage adjustment in the pin 13/14 VR.

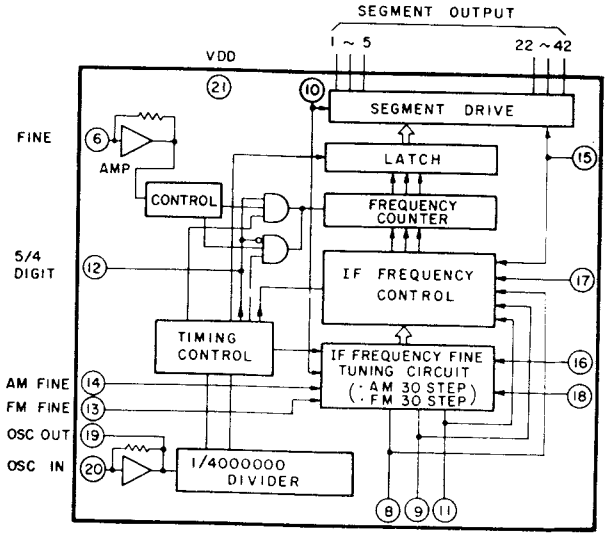


Fig. 4-9 LC7258 Block diagram

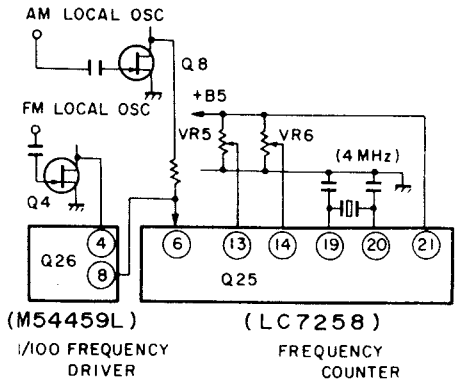
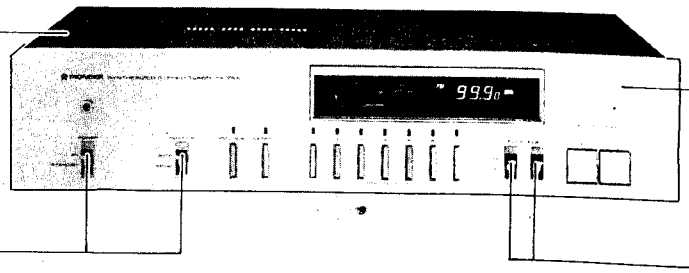


Fig. 4-8 Display circuit

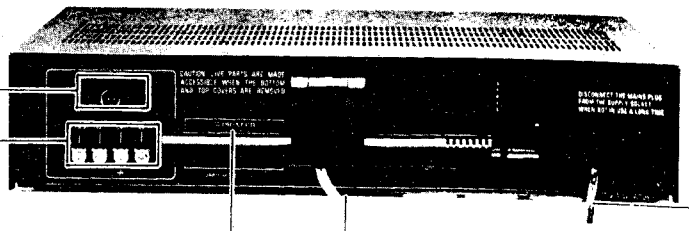
5. PARTS LOCATION

- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*

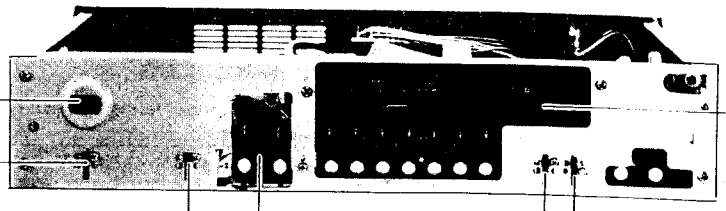
Front Panel View



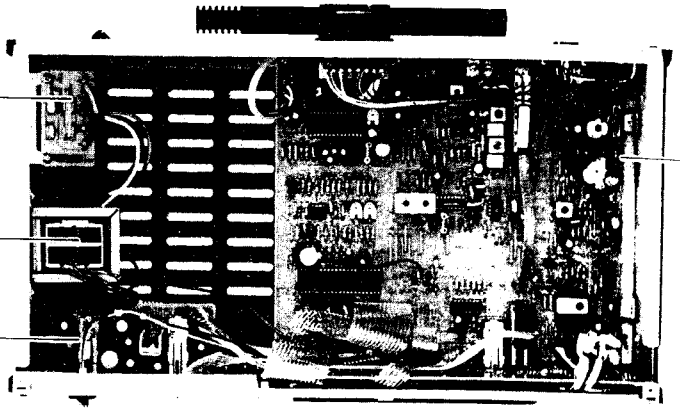
Rear Panel View



Front Panel with Panel Removed



Top View with Top Plate Removed



6. ADJUSTMENTS

FM Tuner

- Connect the FM SG (FM signal generator) to the FM ANTENNA 300Ω terminal via 300Ω dummy antenna.
- Set the FUNCTION switch to the FM position, FM LOCAL switch to the OFF position.
- Connect a terminal no. 14 on the tuner assembly to the ground.
- Apply a DC voltage [0.7V ~ V. REF (8.6V)] across no.16 and ground of tuner assembly

Step	FM SG (400Hz, 75kHz DEV)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	Apply a DC 0.7V across terminal no. 16 and ground.				
2	87MHz	80dB	.....	T3	Increase the voltage at pin 13 of IC (PA3001-A) to maximum level.
3	Apply a DC 8.6V across terminal no. 16 and ground.				
4	109MHz	80dB	.....	TC3	Increase the voltage at pin 13 of IC (PA3001-A) to maximum level.
5	Repeat steps 1 to 4 until both requirements are satisfied.				
6	106MHz	80dB	.....	.....	
7	Adjust the applied voltage to maximum level at pin 13 of IC (PA3001-A).				
8	106MHz	20dB	106MHz (±200kHz)	TC1	Increase the voltage at pin 13 of IC (PA3001-A) to maximum level.
9				TC2	
10	90MHz	80dB	.....	.....	.....
11	Adjust the applied voltage to maximum level at pin 13 of IC (PA3001-A).				
12	90MHz	20dB	90MHz (±200kHz)	T1	Increase the voltage at pin 13 of IC (PA3001-A) to maximum level.
13				T2	
14	Repeat steps 6 to 13 both requirements are statisfied.				
15	98MHz	20dB	98MHz (±200kHz)	T4	Increase the voltage at pin 13 of IC (PA3001-A) to maximum level.
16	No signal		.....	.....	.....
17	Adjust the applied voltage to maximum level at pin 13 of IC (PA3001-A).				
18	No signal		.....	T5 (A)	Obtain reading of DC 0V between terminals no. 30 and 31.
19	98MHz	20dB	.....	.....	.....
20	Adjust the applied voltage to minimum level at pin 13 of IC (PA3001-A).				
21	98MHz	60dB	98MHz (±200kHz)	T5 (B)	Obtain minimum distortion in the demodulated output (OUTPUT).
22	Repeat steps 16 to 21 until both requirements are satisfied.				
23	No signal		.....	.....	.....
24	Adjust the applied voltage to maximum level at pin 13 of IC (PA3001-A).				
25	No signal		.....	VR2	Obtain a reading of DC 4.75V (within ±200mV) between terminal no. 15 and ground.

FM Multiplex Decoder circuit

- Connect the MPX SG (FM multiplex signal generator) to the FM SG external modulator terminal.
- Set the FM SG output to 98MHz and 66dB (modulation mode to external), and tune the TX-710L to 98MHz.

Step	FM MPX SG	Adjustment point	Adjustment method
1	No signal (unmodulated)	VR3	Obtain a 76kHz (within ±250Hz) signal at terminal No.17.
2	Pilot signal only 19kHz ±7.5kHz DEV.	VR4	Obtain minimum leakage of the 19kHz pilot signal at the OUTPUT terminal.
3	Main: 1kHz, L+R, ±67.5kHz DEV. Pilot: 19kHz, ±7.5kHz DEV.	T4 (by up to 90° in either direction)	Reduce distortion in the output terminal to a minimum.

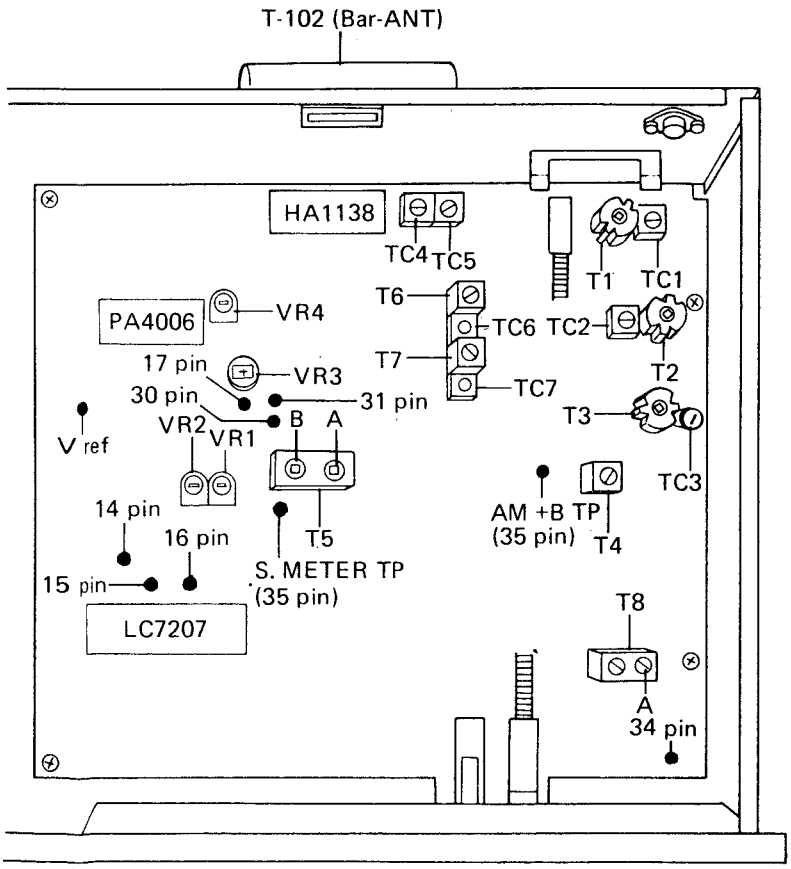
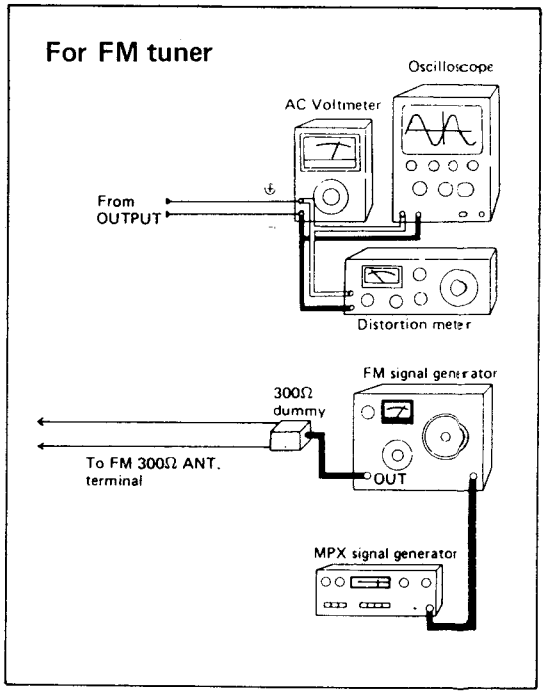
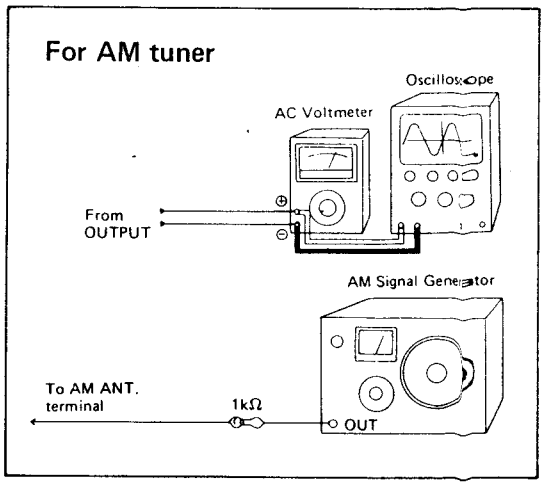


Fig. 6-1 Adjustment of AM and FM tuner





AM Tuner MW Band

- Connect the AM SG (AM signal generator) to the AM ANTENNA terminal via 1kΩ resistor.
- Set the FUNCTION selector to the MW position.
- Connect a terminal no.14 on the tuner assembly to the ground.
- Apply a DC voltage [0.7V ~ V. REF (8.6V)] across no. 16 and ground of tuner assembly.

Step	AM SG (400Hz, 30% MOD)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	Apply a DC 0.7V across terminal no. 16 and ground.				
2	510kHz	100dB	.....	T7	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
3	Apply a DC 8.6V across terminal no. 16 and ground.				
4	1650kHz	100dB	.....	TC7	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
5	Repeat steps 1 to 4 until both requirments are satisfied.				
6	1400kHz	100dB	.....	.....	.....
7	Adjust the applied voltage to maximum level at pin 9 of IC (HA1138).				
8	1400kHz	40dB	1400kHz (±3kHz)	TC5	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
9	600kHz	100dB	.....	.....	.....
10	Adjust the applied voltage to maximum level at pin 9 of IC (HA1138).				
11	600kHz	40dB	600kHz (±3kHz)	T102 (Bar-ANT)	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
12	Repeat steps 6 to 11 until both requirements satisfied.				
13	1000kHz	40dB	.....	.....	Fine tuning (1000kHz)
14	Connect the terminals no.23 to no.27 tuner assembly.				
15	No signal		.....	VR1	Obtain a reading of DC 4.75V (within ±200mV) between terminal no.15 and ground.
16	Adjust the applied voltage to maximum level at pin 9 of IC (HA1138).				
17	1000kHz	40dB	1000kHz (±3kHz)	TA8(A)	Obtain a reading of DC 4.75V (within ±200mV) between terminal no.15 and ground.

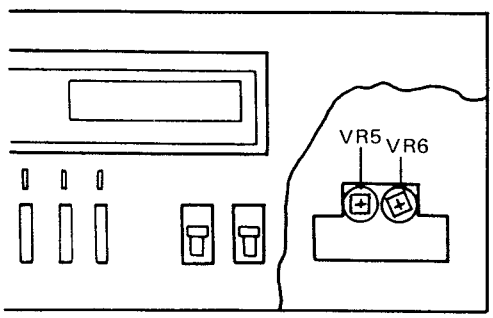


Fig. 6-2 Adjustment of counter

AM Tuner LW Band

- Connect the AM SG (AM signal generator) to the AM ANTENNA terminal via 1kΩ resistor.
- Set the FUNCTION selector to the LW position.
- Connect a terminal no.14 on the tuner assembly to the ground.
- Apply a DC voltage [0.7V ~ V. REF (8.6V)] across no.16 and ground of tuner assembly.

Step	AM SG (400Hz, 30% MOD)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	Apply a DC 0.7V across terminal no. 16 and ground.				
2	140kHz	100dB	.....	T6	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
3	Apply a DC 8.6V across terminal no. 16 and ground.				
4	380kHz	100dB	.....	TC6	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
5	Repeat steps 1 to 4 until both requirements are satisfied.				
6	350kHz	100dB	.....	.....	.....
7	Adjust the applied voltage to maximum level at pin 9 of IC (HA1138).				
8	350kHz	40dB	350kHz (±3kHz)	TC4	Increase the voltage at pin 9 of IC (HA1138) to maximum level.
9	150kHz	100dB	.....	.....	.....
10	Adjust the applied voltage to maximum level at pin 9 of IC (HA1138).				
11	150kHz	40dB	150kHz (±3kHz)	T102 (Bar-ANT)	Increase the voltage at pin 9 IC (HA1138) to maximum level.
12	Repeat steps 6 to 11 until both requirements satisfied.				

Counter

FM

- Connect the FM SG (FM signal generator) to the FM ANTENNA 300Ω terminal via 300Ω dummy.
- Set the FUNCTION selector the FM position, FM LOCAL switch to the OFF position.
- Connect an 12kΩ resistor between 34 pin and ground.

Step	FM SG (400Hz, ±75kHz DEV)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	98MHz	60dB	98MHz (±200Hz)	VR5	• Tune by auto-search tuning. • Then adjust VR5 so that the 100kHz unit in the digital display (98.00MHz) stops brinking on and off upon auto-stop.

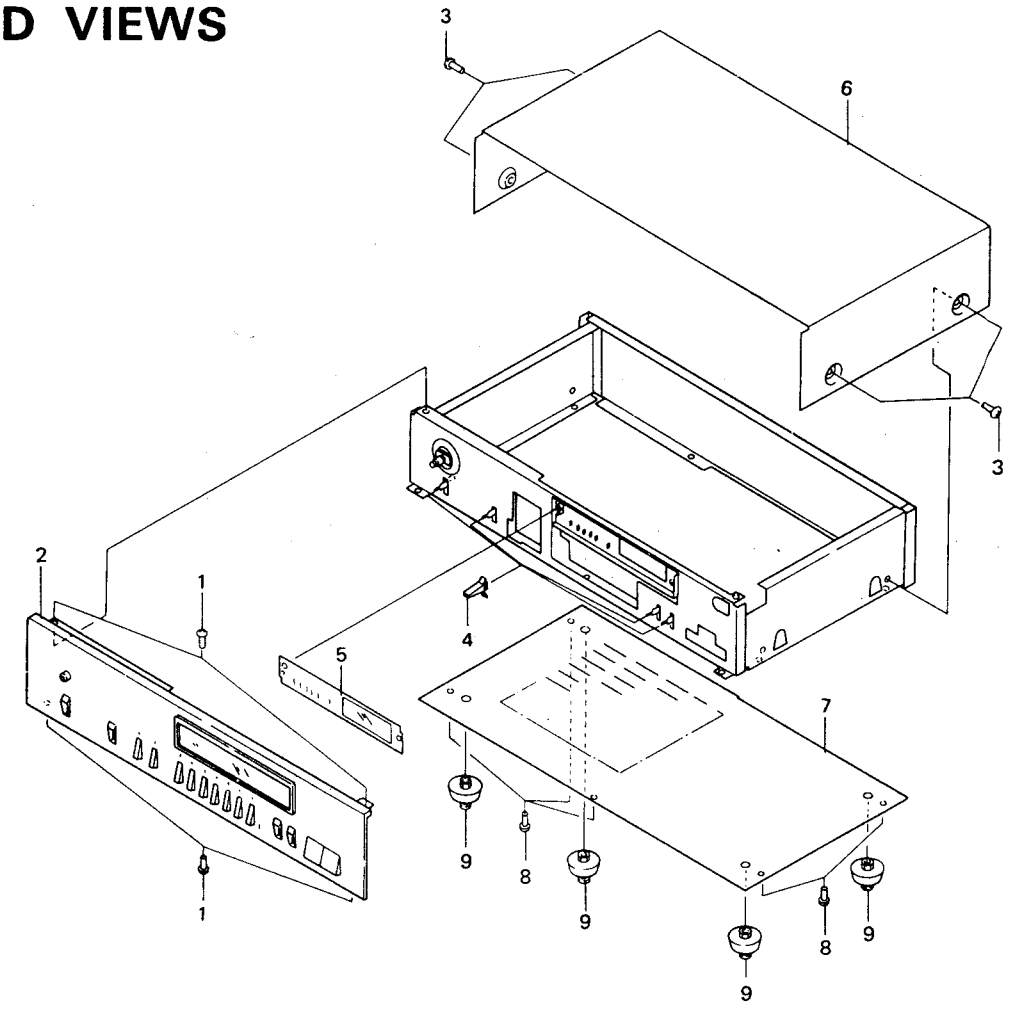
AM

- Connect the AM SG (AM signal generator) to the AM ANTENNA terminal via 1kΩ resistor.
- Set the FUNCTION selector to the AM (MW) position.
- Connect an 33kΩ resistor between 34 pin and AM + B TP.

Step	AM SG (400Hz, 30% MOD)		Frequency on the display	Adjustment point	Adjustment method
	Frequency	Level			
1	1000kHz	60dB	1000kHz	VR6	• Tune by auto-search tuning. • Then adjust VR6 so that the 1kHz unit in the digital display (1000kHz) stops brinking on and off upon auto-stop.

7. EXPLODED VIEWS

Exterior Components



NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*

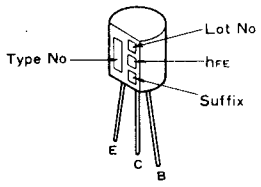
Parts List

Key No.	Part No.	Description
1.	VBZ30P060FMC	Screw
2.	ANB-908	Front panel assembly
3.	FBT40P080FZK	Screw
4.	AAD-200	Lever knob
5.		Acrylic plate A
6.	ANE-291	Bonnet case
7.		Bottom plate
8.	ABA-246	Screw
9.	AEC-609	Foot assembly

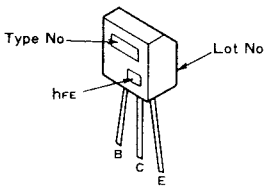
8. SCHEMATIC DIAGRAM, P.C. BOARDS CONNECTION DIAGRAM AND PARTS LIST

External Appearance of Transistors and ICs

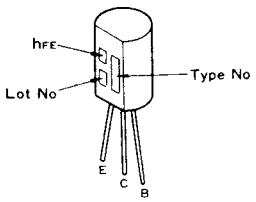
2SA733A
2SC945A



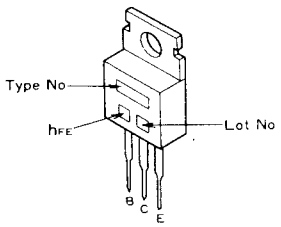
2SC461
2SC535



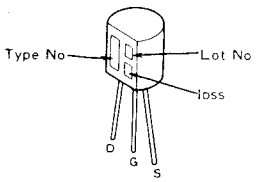
2SC1384



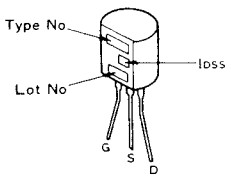
2SD836A



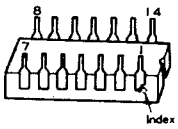
2SK61



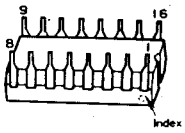
2SK168



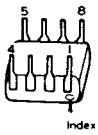
μPD4011C
MB84011M



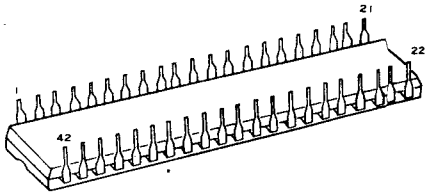
HA1138
PA3001



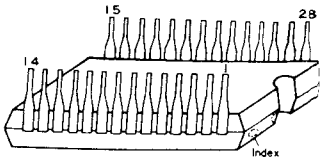
HA1201
μPC4558C
NJM4558DV



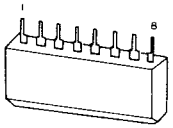
LC7207
LC7258



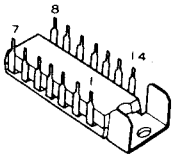
PA4006-A



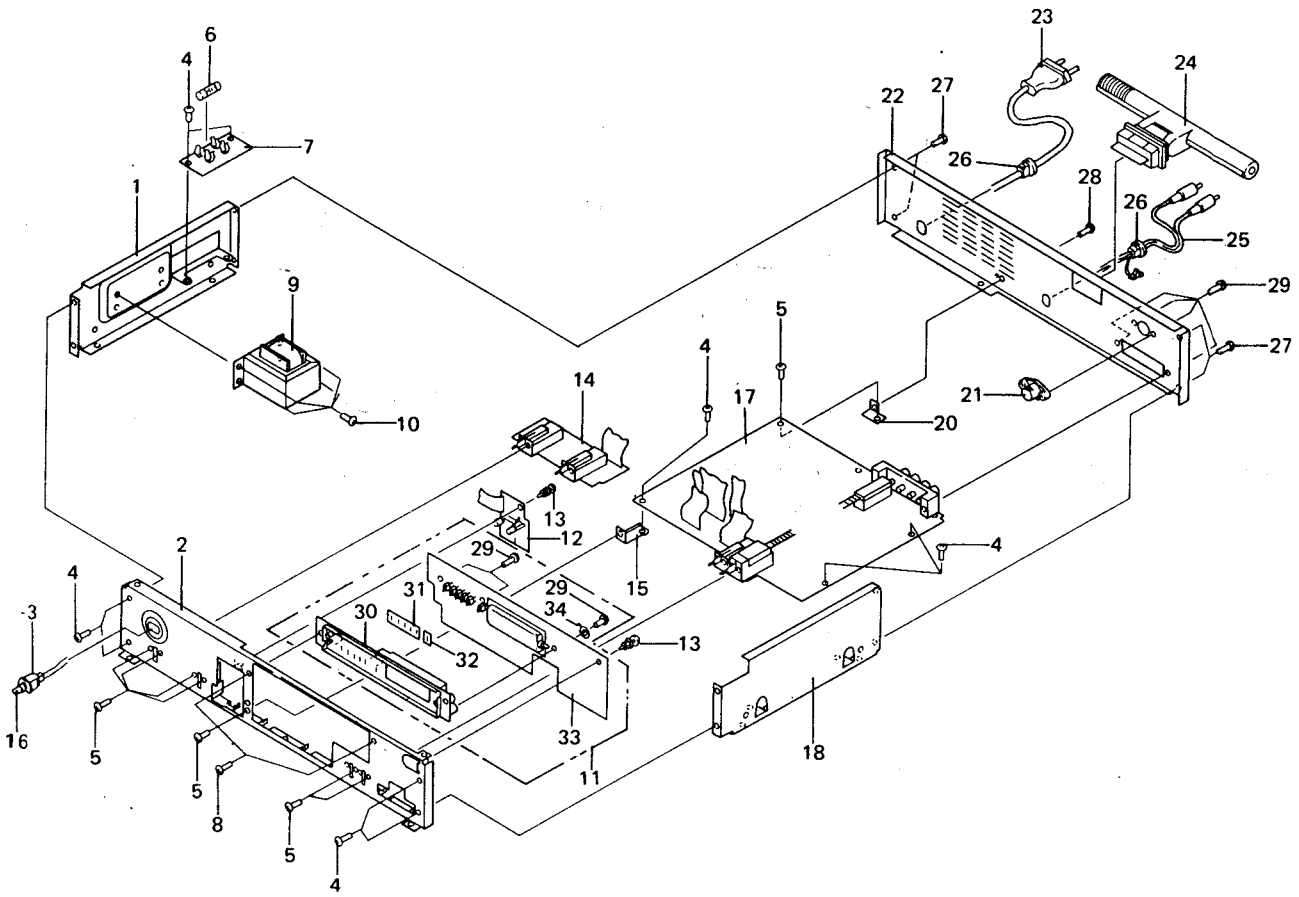
M54459L



LB1416



Interior Components



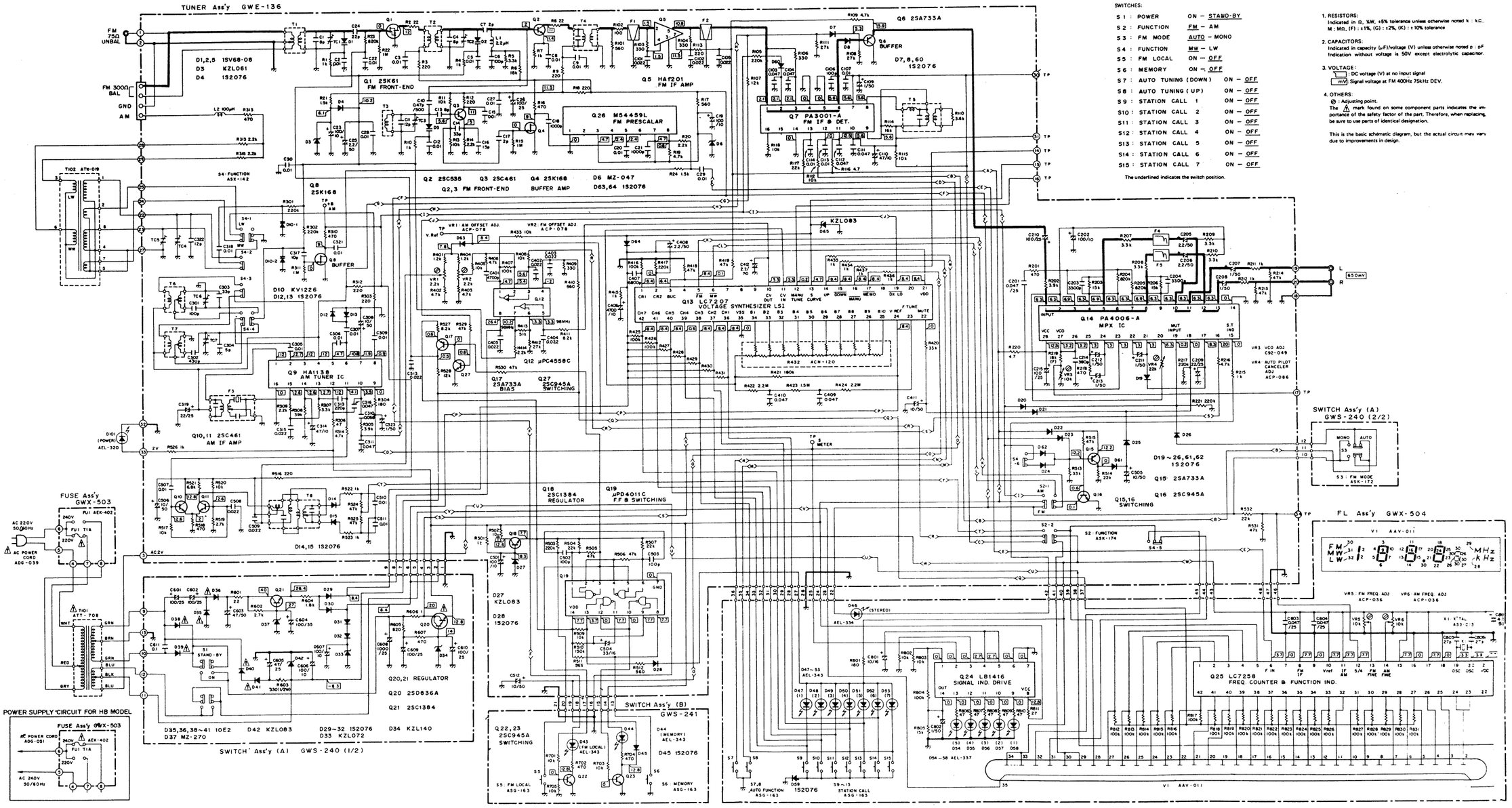
Parts List

Key No.	Part No.	Description
1.		Side frame L
2.		Panel stay
3.		LED socket
4.	VBZ30P060FMC	Screw
5.	PMZ30P060FMC	Screw
⚠ 6.	AEK-402	Fuse T1A (FU1)
⚠ 7.	GWX-503	Fuse assembly
8.	VBZ30P080FMC	Screw
⚠ 9.	ATT-708	Power transformer
10.	VBZ40P080FZK	Screw
11.	GWX-504	FL assembly
12.	GWS-241	Switch assembly B
13.	AEC-510	Nylon rivet
14.	GWS-240	Switch assembly A
15.		PCB holder A
16.	AEL-320	LED D1
17.	GWE-136	Tuner assembly
18.		Side frame R
19.		.....
20.		PCB holder B

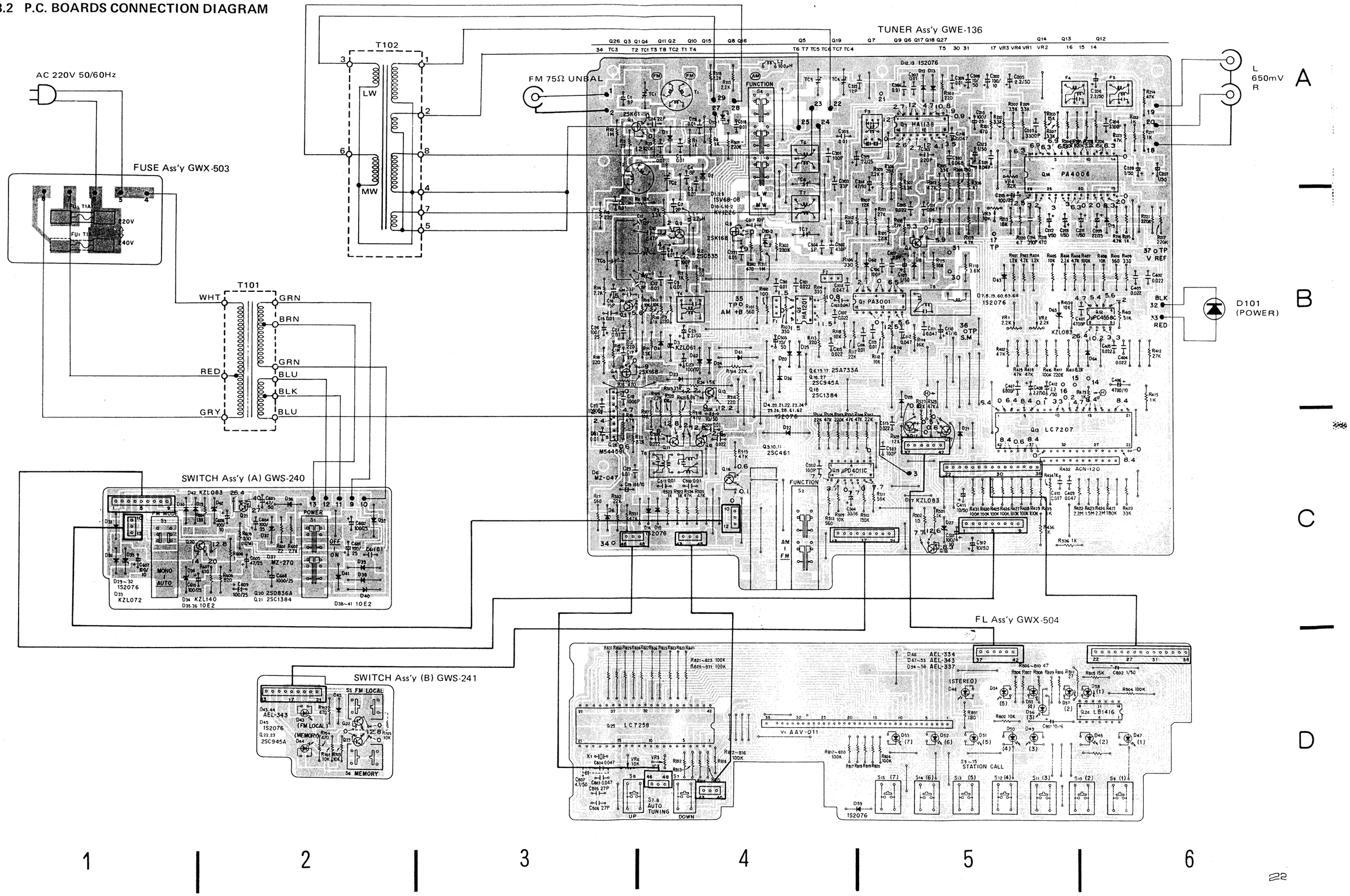
Key No.	Part No.	Description
21.	AKP-016	Coaxial socket
22.		Rear panel
⚠ 23.	ADG-039	AC power cord (HE type)
⚠	ADG-051	AC power cord (HB type)
24.	ATX-019	Bar-antenna assembly
25.	ADE-033	Connection cord
26.	AEC-327	Strain relief
27.	BBT30P080FZK	Screw
28.	PMT30P060FZK	Screw
29.	VBZ30P100FZK	Screw
30.		FL cover
31.		Felt A
32.		Felt B
33.		P.C. board
34.	ABE-061	Washer

8.1 SCHEMATIC DIAGRAM

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.



8.2 P.C. BOARDS CONNECTION DIAGRAM



8.3 PARTS LIST

NOTES:

- *When ordering resistors, first convert resistance values into code form as shown in the following examples.*

  Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560Ω	*56 x 10¹*	*561*	*RD¼PS 5 6 1 J*
47kΩ	*47 x 10³*	*473*	*RD¼PS 4 7 3 J*
0.5Ω	*0R5*		*RN2H 0 R 5 K*
1Ω	*010*		*RSIP 0 1 0 K*

  Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ	*562 x 10¹*	*5621*	*RN¼SR 5 6 2 1 F*

- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*

Miscellaneous Parts

P.B. BOARD ASSEMBLIES

Part No.	Symbol & Description	
GWE-136		Tuner assembly
GWS-240		Switch assembly (A)
GWS-241		Switch assembly (B)
GWX-503		Fuse assembly
GWX-504		FL assembly

OTHERS

Part No.	Symbol & Description	
⚠ AEK-402	FU1	Fuse T1A
⚠ ADG-039		AC power cord (HE type)
⚠ ADG-051		AC power cord (HB type)
⚠ ATT-708	T101	Power transformer
AKP-016		Coaxial socket
ATX-019		Bar-antenna
ADG-033		Connection cord

TUNER ASSEMBLY (GWE-136)

Parts List

TRANSFORMERS, COILS

Part No.	Symbol & Description	
ATC-112	T1	FM antenna coil
ATC-121	T2	FM high frequency coil
ATC-115	T3	FM OSC coil
ATE-039	T4	FM IFT
ATE-043	T5	FM DET. transformer
ATD-008	T6	LW OSC coil
ATB-067	T7	AM OSC coil
ATB-070	T8	AM DET. transformer
ATF-053	F1, F2	FM ceramic filter
ATF-108	F3	AM ceramic filter
ATF-089	F4, F5	Low pass filter
T24-028	L1	RF coil

CAPACITORS

Part No.	Symbol & Description	
ACM-008	TC1, TC2	Film trimer
ACM-006	TC3	Ceramic trimer
ACM-010	TC4, TC6, TC7	Film trimer capacitor
ACM-009	TC5	Film trimer capacitor
CCDRH 080D 50	C1, C4, C13	
CGB R47K 500	C10	
CCDCH 020C 50	C7, C17	
CCDCH 100D 50	C317	
CCDCH 150J 50	C16	
CCDCH 220J 50	C24	
CCDCH 330J 50	C14	
CCDPH 120J 50	C11	
CCDTH 330J 50	C303	
CCDUJ 120J 50	C322	
CCDTH 050C 50	C304	
CCDSL 101J 50	C6, C106, C502, C503	
CKDYB 102K 50	C18, C20	
CKDYB 221K 50	C313	
CKDYB 472K 50	C401	
CKDYB 682K 50	C407	
CKDYF 103Z 50	C2, C3, C5, C8, C9, C12, C15, C21–C22, C27–C30, C107, C113, C114, C305–C307, C309, C318, C321, C510, C511, C507	
CKDYF 223Z 50	C101, C102, C105, C315, C402–C405, C513, C508, C509	
CKDYF 473Z 50	C104, C112, C316, C409–C111, C103	
CKDYX 473M 25	C201, C311	
CQMA 683K 50	C310	
CQMA 332J 50	C203, C204	
CQSH 101K 50	C301	
CEA 010M 50L	C211–C213, C207, C208, C109, C323	

Part No.	Symbol & Description	
CEA 100M 50L	C210, C308, C411, C506, C512, C505	
CEA 101M 10L	C19, C23, C202, C501	
CEA 101M 25L	C26, C215	
CEA 2R2M 50L	C25, C205, C206, C408, C412	
CEA 220M 25L	C209, C319	
CEA 330M 16L	C504	
CEA 470M 10L	C110, C314	
CEA 472M 10L	C406	
CQSH 431K 50	C302	
CEA 4R7M 50L	C807	
ACG-018	C214	Ceramic capacitor

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description	
RD¼PM □□□ J	R1–R24, R101–R118, R201–R218, R220, R301–R304, R306–R315, R401–R431, R433–R436, R501, R503–R507, R509–R532, R221	
RD¼VM 102J	R437	
RN¼PQ □□□□ F	R219	
ACN-120	R432	Radder resistor
ACP-078	VR1, VR2	Semi-fixed
C92-049	VR3	Semi-fixed
ACP-086	VR4	Semi-fixed

SEMICONDUCTORS

Part No.	Symbol & Description
2SK61-Y	Q1
2SC535	Q2
2SC461	Q3, Q10, Q11
(2SC710	Q10, Q11)
2SK168	Q4, Q8
HA1201	Q5
2SA733A	Q6, Q15, Q17
PA3001-A	Q7
HA1138	Q9
μPC4558C	Q12
(NJM4558DV)	
LC7207	Q13
PA4006-A	Q14
2SC945-A	Q16, Q27
2SC1384	Q18
μPD4011C	Q19
(MB84011M)	
M54459L	Q26
1SV68-08	D1, D2, D5
KZL-61	D3
1S2076	D4, D7, D8, D12–D15, D19–D26, D28, D60–D64
(1S2473)	
(1S1555)	

Part No.	Symbol & Description
MZ-047	D6
KV1226-Y	D10
KZL083	D27, D65

SWITCHES AND OTHER

Part No.	Symbol & Description	
ASK-174	S2	Lever switch
ASX-142	S4	Slide switch
ASX-140		Remote switch
AKA-016		Terminal (ANTENNA)

SWITCH ASSEMBLY A (GWS-240)

Parts List

CAPACITORS

Part No.	Symbol & Description
CEA 101M 25L	C601, C602, C609, C610
CEA 101M 10L	C606, C607
CEA 101M 35L	C604
CEA 102M 25L	C608
CEA 470M 25L	C605
CEA 470M 50L	C603
CQMA 104K 50	C611

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description
RD¼PM □□□ J	R601, R602, R604–R607
RD½PS 331J	R603

SEMICONDUCTORS

Part No.	Symbol & Description
⚠ 2SD836A	Q20
2SC1384	Q21
1S2076	D29–D32
(1S2473)	
(1S1555)	
KZL072	D33
KZL140	D34
⚠ 10E2	D35, D36, D38–D41
MZ-270	D37
KZL083	D42

SWITCHES AND OTHER

Part No.	Symbol & Description	
⚠ ASK-179	S1	Lever switch
ASK-172	S3	Lever switch
VBZ30P060FMC		Screw

SWITCH ASSEMBLY B (GWS-241)

Parts List

RESISTORS AND SWITCHES

Part No.	Symbol & Description	
RD¼PM □□□ J	R701–R705	
ASG-163	S5, S6	Tact switch

SEMICONDUCTORS

Part No.	Symbol & Description
2SC945A	Q22, Q23
AEL-343	D43, D44
1S2076	D45
(1S2473)	
(1S1555)	

FL ASSEMBLY (GWX-504)

Parts List

CAPACITORS

Part No.	Symbol & Description
CEB 100P 16	C801
CEB 010P 50	C802
CKDYX 473M 25	C803, C804
CCDCH 270J 50	C805, C806

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description	
ACP-036	VR5, VR6	Semi-fixed 10kΩ
RD¼PM □□□ J	R801–R831	

SEMICONDUCTORS

Part No.	Symbol & Description	
LB1416	Q24	
LC7258	Q25	
AEL-343	D47–D53	LED
AEL-337	D54–D58	LED
1S2076	D59	
(1S2473)		
(1S1555)		
AEL-334	D46	LED (STEREO IND)

SWITCHES AND OTHERS

Part No.	Symbol & Description	
ASG-163	S7–S14	Tact switch
ASS-013	X1	Crystal resonator
AAV-011	V1	Fluorescent indicator tube
VBZ30P100FZK		Screw
ABE-061		Washer

9. PACKING

Parts List

Key No.	Part No.	Description
1.	AHD-788	Packing case
2.	AHA-234	Side pad
3.	ADH-004	FM antenna
4.	ARB-376	Operating instructions (English)
5.	ARD-150	Operating instructions (German/French for HE type only)